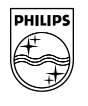
DATA SHEET

TDA4860
Vertical deflection power amplifier for monitors

Product specification
Supersedes data of September 1991
File under Integrated Circuits, IC02

1996 Nov 26

Philips
Semiconductors





Vertical deflection power amplifier for monitors

TDA4860

FEATURES

- Vertical pre-amplifier with differential inputs
- Powerless vertical shift
- Flyback voltage generation suitable for two operating modes (doubling the supply voltage or external supply for the short flyback time, this achieves a minimum of power dissipation)
- Vertical output stage with thermal and SOAR protection
- High deflection frequency up to 140 Hz
- High linear sawtooth signal amplification
- Possibility of guarding the deflection
- Voltage stabilizer.

GENERAL DESCRIPTION

The TDA4860 is a vertical power amplifier for differential input signals suitable for colour monitor/TV systems with deflection frequencies up to 140 Hz.

QUICK REFERENCE DATA

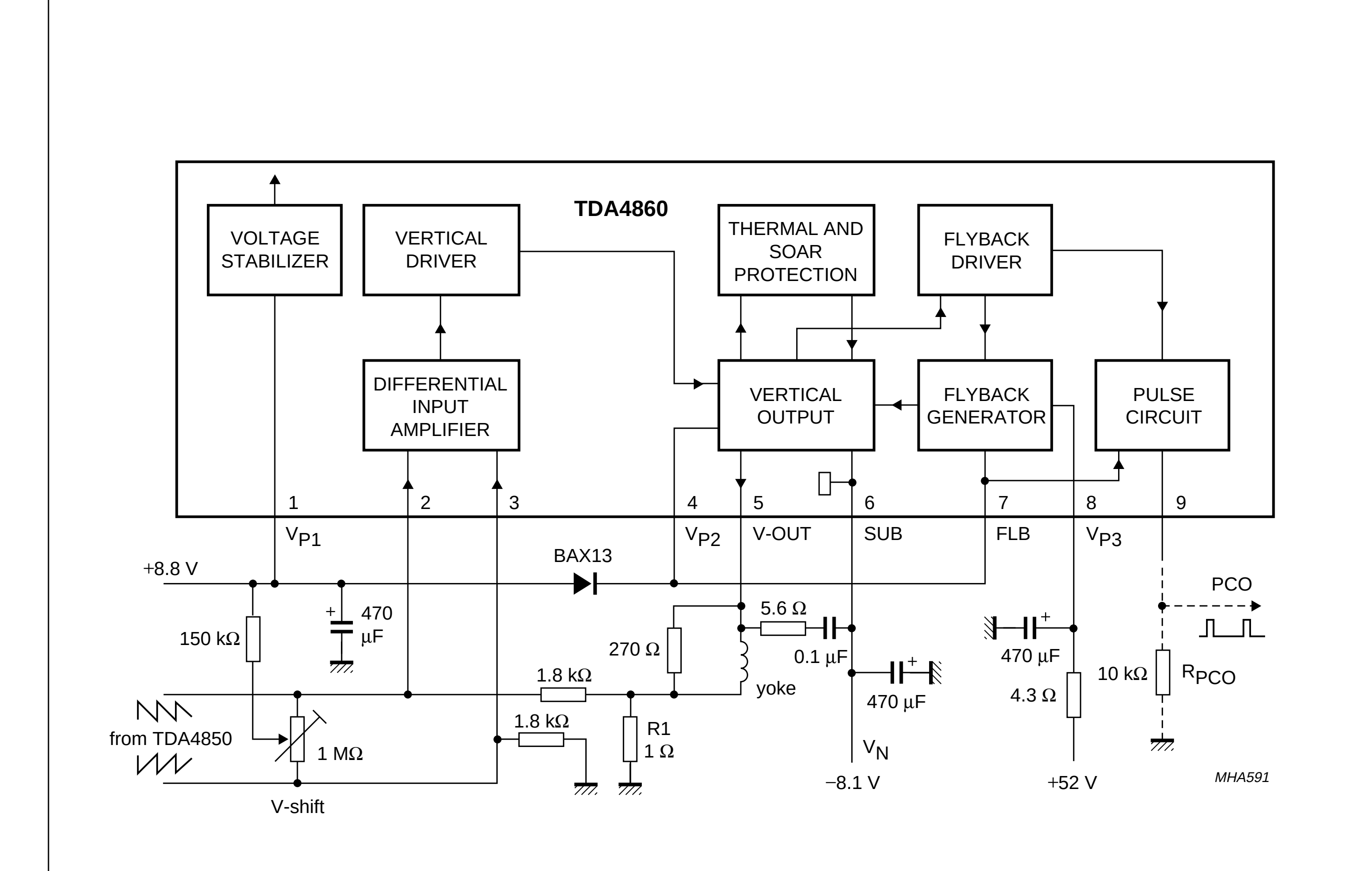
Measurements referenced to substrate (pin 6).

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{P1}	supply voltage (pin 1)	9	–	30	V
V_{P2}	supply voltage (pin 4)	9	–	60	V
V_{P3}	flyback supply voltage (pin 8)	9	–	60	V
I_{P1}	supply current (pin 1)	–	–	10	mA
I_{P2}	supply quiescent current (pin 4)	–	9	–	mA
V_I	input voltage (pins 2 and 3)	1.6	–	V_{P1} – 0.5	V
$I_{5\ M}$	deflection output current (maximum value; pin 5)	–	–	±1	A
T_{amb}	operating ambient temperature	–20	–	+75	°C

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA4860	SIL9MPF	plastic single in-line medium power package with fin; 9 leads	SOT110-1

BLOCK DIAGRAM



Assumed values:

I_{yoke} = 1.42 A.

R_{yoke} = 4.17 Ω + 7% + ΔR(T) = 6.12 Ω.

L_{yoke} = 5.25 mH.

R_1 = 1.0 Ω ±1%.

T_{amb} = 65 °C.

$T_{j(max)}$ = 105 °C.

T_{yoke} = 75 °C.

P_{yoke} = 1.2 W.

P_{IC} = 1.8 W.

P_{tot} = 3.0 W.

$t_{p\,FLB}$ = typically 250 µs.

Attention: the heatsink of the IC must be isolated against ground; the cooling fin is connected to pin 6.

Fig.1 Block diagram and application circuit with flyback supply voltage V_{P3} from an external source. Deflection frequency range from 50 Hz to 100 Hz.

PINNING

SYMBOL	PIN	DESCRIPTION
V_{P1}	1	supply voltage 1
INP1	2	input 1 of differential input amplifier
INP2	3	input 2 of differential input amplifier
V_{P2}	4	supply voltage 2 for vertical output stage
V-OUT	5	vertical output
SUB	6	substrate
FLB	7	flyback generator output
V_{P3}	8	flyback supply voltage 3
PCO	9	pulse circuit output

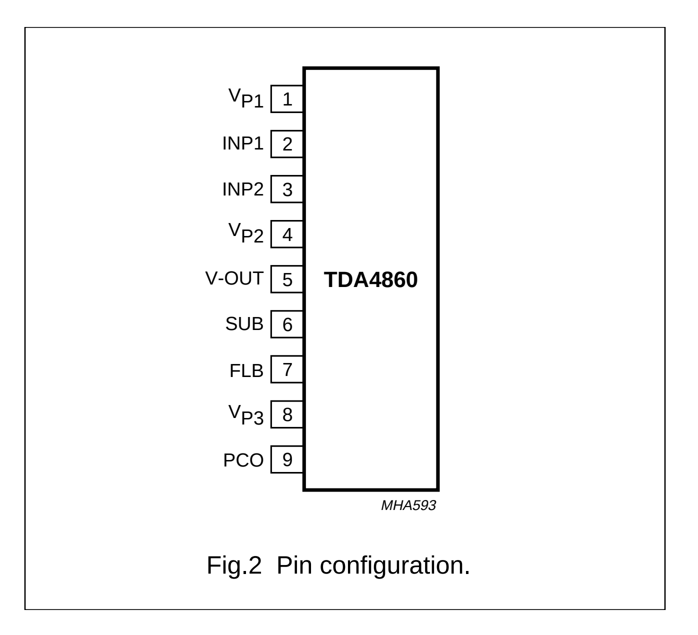


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

Differential input amplifier

The differential sawtooth input signal (coming from a ramp output of the TDA4850 for example) is fed to the input pins 2 and 3. The non-inverted signal is attached to pin 3. The vertical feedback signal is superimposed on the inverted input signal on pin 2.

Vertical shift is applied at the inputs in a power-less way (see Fig.1).

Flyback generator

Signals for the flyback generator and the pulse circuit are generated in the flyback driver stage. The flyback output consists of a Darlington transistor and a flyback diode. The flyback generator can operate in two modes:

1. An external supply voltage is applied for the short flyback time, thus the power dissipation is minimum (see Fig.1).
2. The flyback voltage is generated by doubling the supply voltage (see Fig.5). The 100 µF capacitor C2 between pins 4 and 7 is charged up to V_{P1} during scan, using the external diode and the resistor R2. The cathode of the capacitor C2 is connected to the positive rail during flyback. Thus, the flyback voltage is twice the supply voltage.

Vertical output

The vertical output stage is a quasi-complementary class-B amplifier with a high linearity. The output contains SOAR (short-circuit protection) and thermal protection. The output current on pin 5 is reduced for a short time (to let the temperature decrease to $T_j < 150$ °C), when the junction temperature (T_j) exceeds 160 °C.

Deflection GUARD

Pin 9 will go HIGH if the junction temperature goes to high (see Fig.3). A pulse signal with 50% duty cycle is output on pin 9, if the deflection coil is open-circuit. A flyback pulse signal is output at normal conditions.

Further watching can be achieved by means of an external GUARD circuit as shown in Fig.4. The 22 µF capacitor is charged during flyback time ($V_5 > V_8$) at normal conditions. In case of failures, the capacitor is discharged and the GUARD output goes HIGH.

GUARD output level (see Fig.4):

- LOW for normal conditions
- HIGH for deflection coil short-circuit respectively open-circuit
- HIGH when there are neither input or output signals.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134); voltages referenced to substrate (pin 6); unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{P1}	supply voltage (pin 1)		–	40	V
V_{P2}	supply voltage (pin 4)		–	60	V
V_{P3}	supply voltage (pin 8)		–	60	V
$V_{2,3,9}$	voltage on pins 2, 3 and 9		–	V_{P1}	V
$V_{5,7}$	voltage on pins 5 and 7		–	60	V
I_4	current on pin 4		–	1	A
$I_{5\ (M)}$	output current on pin 5 (peak value)	note 1	–	±1.3	A
$I_{7\ (M)}$	flyback current on pin 7 (peak value)		–	±1.3	A
I_9	current on pin 9		–	–8	mA
T_{stg}	storage temperature		–25	+150	°C
T_{amb}	operating ambient temperature		–20	+75	°C
T_j	junction temperature	note 1	–	168	°C
V_{es}	electrostatic handling for all pins	note 2	–	±300	V

Notes

1. Internally limited by thermal protection; switching temperature point at 160 ±8 °C.
2. Equivalent to discharging a 200 pF capacitor through a 0 Ω series resistor.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}c}$	thermal resistance from junction to case	10	K/W

The heatsink can be estimated according to application circuit (see Fig.1):

$$R_{th\ j\text{-}a} = R_{th\ j\text{-}c} + R_{th\ c\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j(max)} - T_{amb}}{P_{IC(max)}} = \frac{105\ °C - 65\ °C}{1.8\ W} = 22.2\ K/W\ .$$

A heatsink is needed at $R_{th\ j\text{-}c}$ < 10 K/W and $R_{th\ c\text{-}h}$ = 0.5 K/W (using silicon grease) with $R_{th\ h\text{-}a}$ = 22.2 K/W – (10 + 0.5) K/W = 11.7 K/W.

CHARACTERISTICS

V_{P1} = V_{P2} = 25 V; V_N = V_6 = 0 V; T_{amb} = 25 °C; voltages referenced to substrate (pin 6); unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{P1}	supply voltage 1 (pin 1)		9	25	30	V
V_{P2}	supply voltage 2 (pin 4)		9	25	60	V
V_{P3}	supply voltage 3 (pin 8)		9	–	60	V
I_{P1}	supply current (pin 1)		–	–	10	mA
I_{P2}	quiescent supply current (pin 4)	without input signal	–	9	–	mA
Pre-amplifier						
$V_{2,3}$	input voltage (pins 2 and 3)		1.6	–	V_{P1} – 0.5	V
$I_{2,3}$	input quiescent current	without input signal	–	100	–	nA
Flyback generator						
V_7	output voltage	upper value; I_7 = –1 A	–	V_{P3} – 2.2	–	V
$I_{7(M)}$	flyback output current (maximum value; pin 7)		–	–	±1	A
V_{1-5}	threshold voltage to switch flyback	on/off threshold	–	1.4	–	V
$t_{p\ FLB}$	flyback pulse time	see Figs 1 and 3	–	250	–	µs
Vertical output; see Fig.3						
V_5	output voltage	upper value; I_5 = –1 A	V_{P2} – 2.3	V_{P2} – 2	–	V
		lower value; I_5 = 1 A	–	1.5	1.7	V
$I_{5(M)}$	vertical output current (maximum value; pin 5)		–	–	±1	A
LIN	non-linearity of output signal		–	–	1	%
Pulse circuit output; see Fig.3						
V_9	output voltage	R_{PCO} = 10 kΩ; see Fig.1	0.4	–	V_{P1} – 0.4	V
V_9	output voltage for thermal protection active		V_{P1} – 0.4	–	–	V
V_{1-5}	voltage to insert flyback pulse on pin 9	normal condition	–	–	1.4	V
t_{p9}	pulse width	deflection open-circuit	–	50	–	%
		normal condition	$t_{p\ FLB}$	–	–	µs

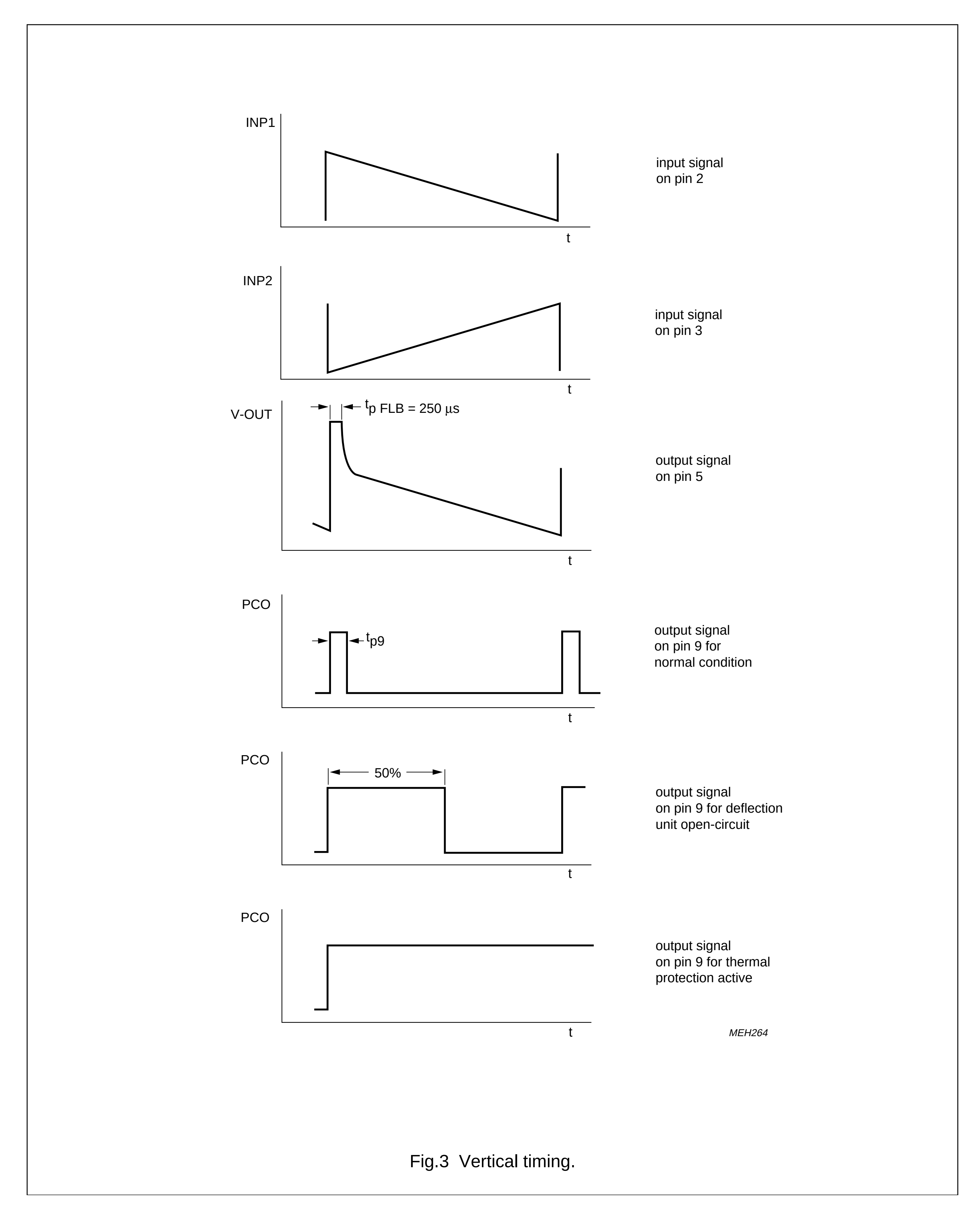


Fig.3 Vertical timing.

APPLICATION INFORMATION

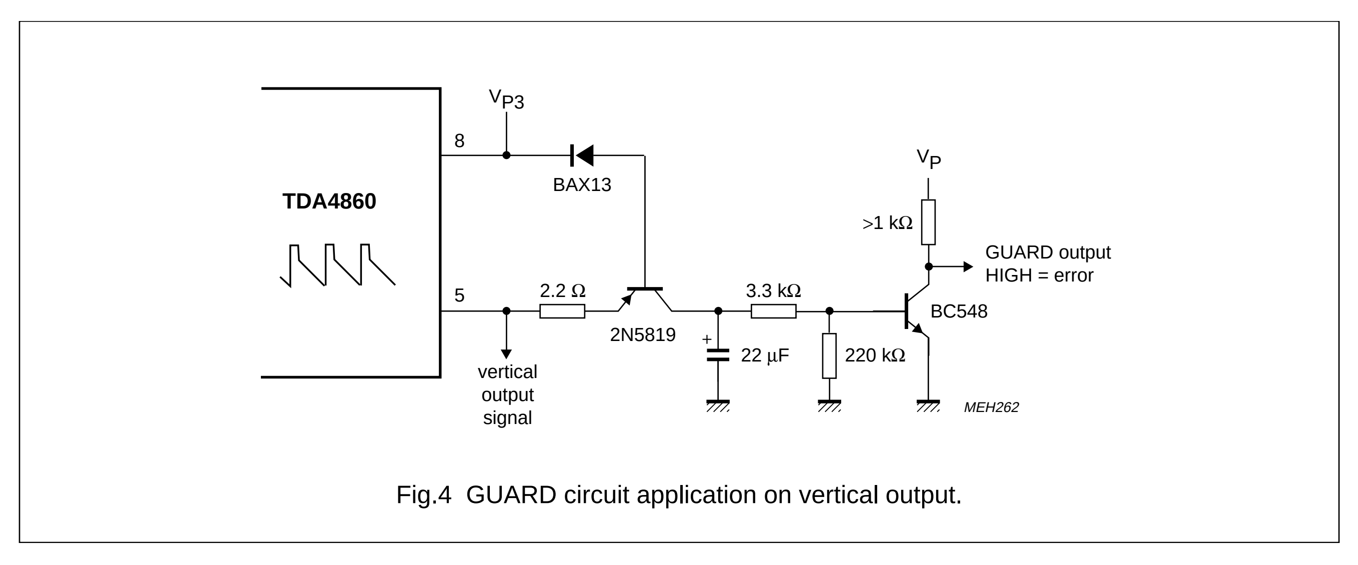


Fig.4 GUARD circuit application on vertical output.

Fig.5 Application for flyback voltage generation by doubling the supply voltage.

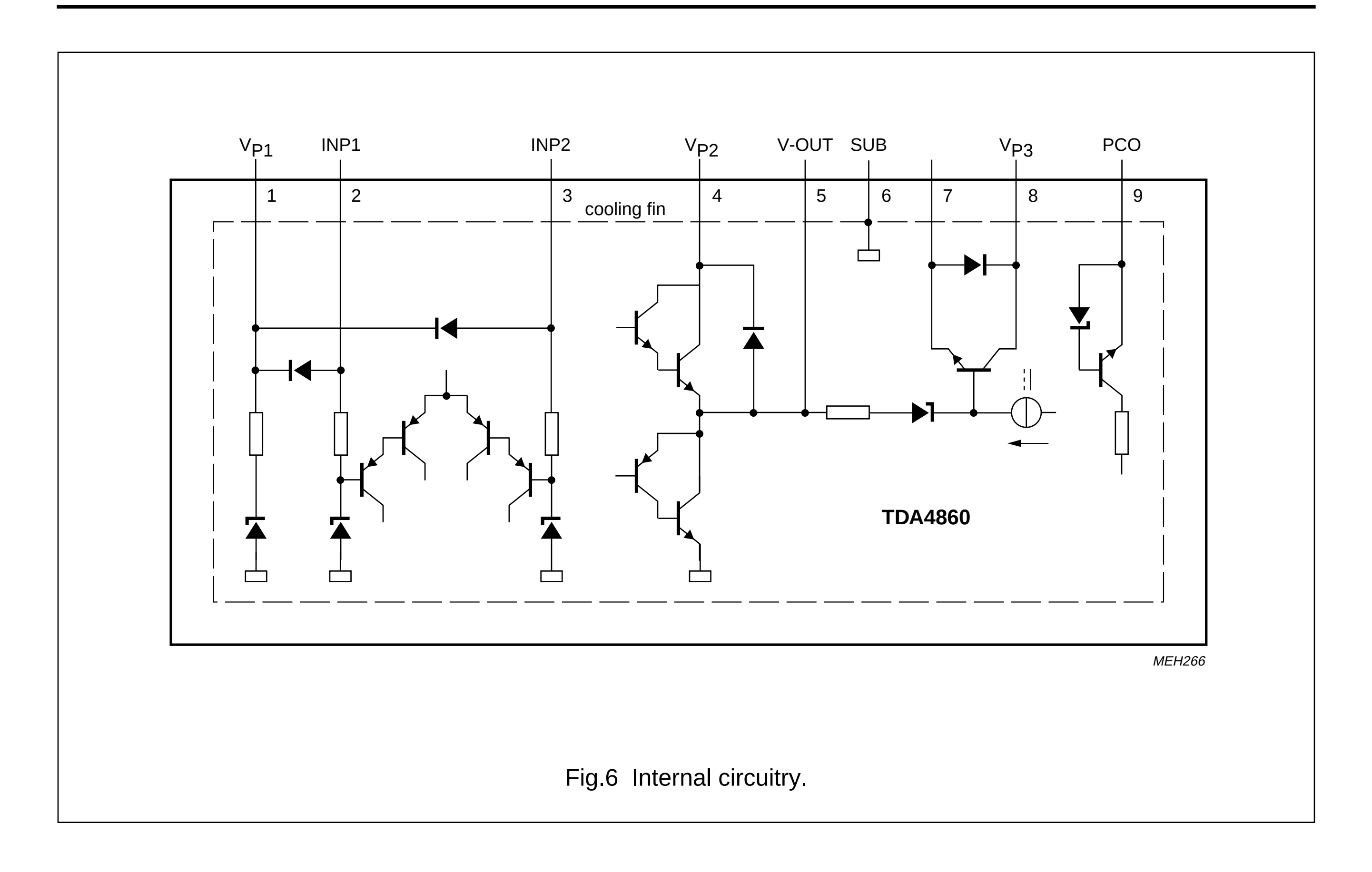
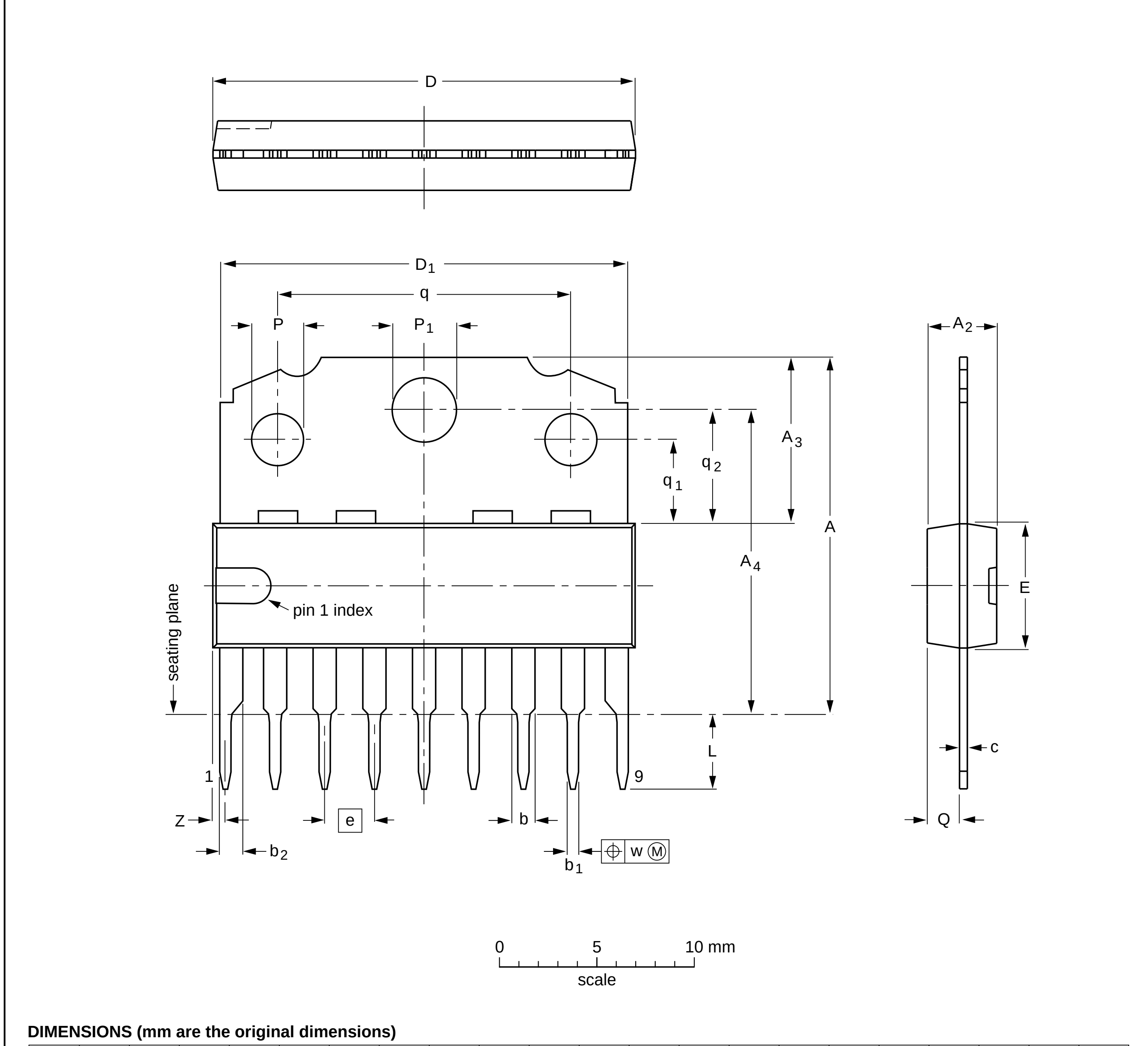


Fig.6 Internal circuitry.

PACKAGE OUTLINE

SIL9MPF: plastic single in-line medium power package with fin; 9 leads **SOT110-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_2 max.	A_3	A_4	b	b_1	b_2	c	D(1)	D_1	E(1)	e	L	P	P_1	Q	q	q_1	q_2	w	Z(1) max.
mm	18.5 17.8	3.7	8.7 8.0	15.8 15.4	1.40 1.14	0.67 0.50	1.40 1.14	0.48 0.38	21.8 21.4	21.4 20.7	6.48 6.20	2.54	3.9 3.4	2.75 2.50	3.4 3.2	1.75 1.55	15.1 14.9	4.4 4.2	5.9 5.7	0.25	1.0

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT110-1						~~92-11-17~~ 95-02-25

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *“IC Package Databook”* (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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